LAWRENCE
LIVERMORE
NATIONAL
LABORATORY

LLNL-PROC-413323

Interface Reconstruction with Directional Walking

J. Yao

May 27, 2009

Multi-Material Workshop
Pavia, Italy
September 21, 2009 through September 25, 2009

Disclaimer

Interface Reconstruction with Directional Walking

Jin Yao

*Lawrence Livermore National Laboratory
yao2@llnl.gov

Abstract

Young's interface reconstruction with three-dimensional arbitrary mesh, in general, is rather tedious to implement compared to the case of a regular mesh. The main difficulty comes from the construction of a planar facet that bounds a certain volume inside a cell. Unlike the five basic configurations with a Cartesian mesh, there can be a great number of different configurations in the case of a general mesh.

We represent a simple method that can derive the topology/geometry of the intersection of arbitrary planar objects in a uniform way. The method is based on a directional walking on the surface of objects, and links the intersection points with the paths of the walking naturally defining the intersection of objects. The method works in both two and three dimensions. The method does not take advantage of convexity, thus decomposition of an object is not necessary. Therefore, the solution with this method will have a reduced number of edges and less data storage, compared with methods that use shape decomposition. The treatment is general for arbitrary polyhedrons, and no look-up tables are needed. The same operation can easily be extended for curved geometry.

The implementation of this new algorithm shall allow the interface reconstruction on an arbitrary mesh to be as simple as it is on a regular mesh. Furthermore, we exactly compute the integral of partial cell volume bounded by quadratic interface. Therefore, interface reconstruction with higher than second order accuracy can be achieved on an arbitrary mesh.

References

[1] Jin Yao, Directional Walking: A Simple Way To Intersect Arbitrary Geometries *LLNL reports LLNL-JRNL-400055*, (2007).

This work was performed under the auspices of the Lawrence Livermore National Security, LLC, (LLNS) under Contract No. DE-AC52-07NA27344.

This work performed under the auspices of the U.S. Department of Energy by Lawrence Livermore National Laboratory under Contract DE-AC52-07NA27344.